AMENDED SPECIFICATION

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PATENT SPECIFICATION

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NO DRAWINGS

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COMPLETE SPECIFICATION

Agglomerating Process

We, THE PROCTER & GAMBLE COMPANY, a company organised under the laws of the State of Ohio, United States of America, of 301 East Sixth Street, Cincinnati, Ohio, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the agglomeration of pulverulent materials, and more particularly, to the agglomeration of flour-containing food particles to provide a non-sticky, free-flowing culinary mix which can be readily blended with or mixed in water and other aqueous systems.

In recent years there has been a trend toward providing the consumer with ready-to-use products having various built-in convenience and time-saving qualities. This has been particularly notable in the culinary arts such as in the field of prepared mixes.

For example, it is now possible for household consumers, as well as commercial bakeries, to prepare baked goods from prepared mixes which contain many of the essential ingredients of the finished food product in a pre-mixed condition.

Frequently however, the prepared food mixes contain ingredients which are not readily dispersible in aqueous systems, such as in a cake batter. One of the important ingredients which is usually incorporated in a cake batter is flour. However, it is well known that fine particles of flour commonly wet only with difficulty upon admixture with water, and tend to form unwetted lumps in the cake batter instead of a smooth mixture. A means for providing improved wettability and dispersibility of such difficulty soluble food materials would find much use in the culinary arts.

According to the present invention a method of agglomerating particles of a pulverulent material comprises contacting the particles with a fine spray of a sticky cohesive binding liquid obtained by passing it through an atomizing nozzle under high pressure, said binding liquid being either a concentrated aqueous sugar solution having a weight ratio of sugar to water of from 1.5:1 to 4:1 in an amount such as to give a total moisture content of the treated particles of from 2 to 10% by weight or being a melted or normally liquid glyceride shortening, and agitating the particles in a gentle manner sufficient to blend the liquid uniformly therewith and to roll up the treated particles upon each other into non-sticky, free-flowing aggregates without drying, said aggregates having a larger particle size than the unagglomerated constituent particles and improved mixing and blending properties in aqueous systems.

By means of the aforesaid agglomerating process, it is possible to provide free-flowing, non-sticky culinary mixes having a great variety of ingredients. For example, among those materials which can be agglomerated by the process of this invention are cake mixes containing flour, sugar, shortening, and other ingredients; pancake mixes; pastry mixes; confectionery mixes; powdered beverages; and other pulverulent substances in general. This invention is particularly useful for the prepar-

[*Price 4s. 6d.*]

ation of flour-containing mixes having sugar and/or shortening incorporated therein.

Most of the prior art agglomerating methods require a final drying step in order to recover a product that is both non-sticky and microbiologically stable. The usual agglomerating methods which require substantial amounts of steam or water as the agglomerating fluid generally require drying of the final aggregates to reduce their moisture content to a level which does not impart stickiness to the product and which does not support the growth of bacteria and mould. A primary advantage of the process of the present invention is its ability to provide a free-flowing aggregate having improved mixing properties that is both non-sticky and resistant to microbial spoilage, yet requires no drying of the product subsequent to the treatment with the agglomerating fluid.

It has now been found possible to avoid the usual drying procedure by providing for a unique depositing of a sticky cohesive binding liquid on to the dry particles while they are tumbled or otherwise agitated, in a manner whereby the said binding liquid loses its stickiness and becomes an integral constituent of the agglomerated mix.

As used herein, the term "liquid" is intended to define a fluid agglomerating substance existing in a liquid phase and excludes the presence of functional crystalline or other solid particles greater than about 0.2μ in diameter. However, it is not hereby intended to exclude the presence in the agglomerating liquid of minor amounts of non-functional, inert solid matter.

The agglomerating liquids of this invention are sticky, cohesive, binding substances and may be either a melted or normally liquid glyceride shortening or a highly concentrated aqueous sugar solution (referred to in more detail below) which can be deposited on the mix in certain levels and intimately blended therewith to become an integral constituent of the said mix.

Shortening and sugar solution are common ingredients of flour-containing products such as cakes and pancakes, while shortening is also an important ingredient of pastry products such as a dough. These ingredients are usually blended with flour and other materials by ordinary mixing methods during the preparation of a batter or dough by the consumer or during the production of a dry prepared mix by the manufacture. It has now been found, however, that if these substances are blended in liquid form, as hereinafter described, in certain proportions with the flour and other materials, a superior dry prepared mix with markedly enhanced blending and mixing properties can be prepared.

Although these agglomerating liquids may be added to the mix before it is agitated, it is preferable to add the liquid while tumbling or other agitation is in progress. The binding liquid is applied by spraying it through an atomizing nozzle under high pressure. A fine spray of sticky liquid applied to a slowly agitated mix provides a thorough and homogeneous blending of a sufficient amount of binding substance with the individual powdered particles and simultaneously rids the said liquid of its inherent stickiness as it is rolled up into the dry aggregates produced thereby.

One method of agitating the moistened particles to produce the free-flowing, non-sticky aggregates without drying is by means of tumbling in a device such as a cylindrical chamber mounted on a horizontal, or slightly inclined, axis and slowly rotating thereon. As the sticky binding liquid of the present invention is sprayed on to the mix which is tumbled in the said manner, the constituent particles of the mix will gently roll up and over each other and adhere together to form aggregates, while the binding liquid is simultaneously depleted of its sticky characteristics and homogeneously blended into the said aggregates.

In a preferred embodiment of this invention the flour-containing particles are placed in a tumbling cylinder mounted on a horizontal axis. The particles should preferably form a fairly shallow bed of material, for example, up to a maximum depth of about 2 to 8 inches thick when at rest in a tumbling cylinder having a diameter of about 2 feet. The cylinder is slowly revolved about its axis at a speed of about 5 to about 50 rpm. The sticky cohesive agglomerating liquid under a high pressure is sprayed through an atomizing nozzle on to the slowly tumbling mix. The gentle agitation produced by this tumbling mechanism provides for a high probability of contact between the particles without thereby producing an unduly hard compaction. It also permits the fine spray of sticky cohesive liquid to become thoroughly dispersed throughout the mixture so that an optimum aggregation of particles can be attained with a maximum loss of stickiness of the liquid thereto. The resulting loosely-compacted aggregate product can be readily blended with or mixed into water and other aqueous systems to form a batter or dough.

Another method of tumbling and spraying comprises atomizing the sticky binding liquid on to a gently agitated fluidized bed of the material to be agglomerated.

The powdered particles which are sprayed and agitated in the hereinbefore-described manner form aggregates which are free-flowing, non-sticky, and ready to be packaged or otherwise used without drying. In this manner, heat-sensitive ingredients of the aggregates, such as flour, are kept completely free of even moderately elevated drying temperatures. In addition, the frangible aggregates are not subjected to breakage which might be caused by the mechanical action of any drying process. The absence of such drying also provides for a consequent reduction in capital investment and processing costs which are otherwise neces-

sary in the usual agglomerating processes.

The following Examples illustrate embodiments of the process of this invention.

EXAMPLE 1

A culinary mix was prepared by mixing together the following ingredients:

	Weight Per Cent
Bleached cake flour	37.8
Sugar (9 parts sucrose; 1 part dextrose)	49.7
Plastic fatty acid triglyceride soybean oil-derived shortening emulsified with mono- and diglycerides and glyceryl lactyl stearate	12.5

A 40-lb. batch of the said mix, having a moisture content of about 3.8%, was heated to about 110°F. and then agglomerated in a slowly rotating horizontal cylindrical chamber about 2 feet long, 2 feet in diameter, and provided on its inner surface with 4 longitudinal radially disposed baffles, each about 2 inches high. A sticky binding liquid was prepared by mixing 3 parts of sucrose with 1 part of water and heating to 180°F. This liquid, under a pressure of 3000 psi, was then sprayed on to the mix from an atomizing nozzle for 3 minutes while the cylinder was being rotated at a speed of about 20 rpm to produce an agglomerated mix having a total moisture content of about 4.9 per cent.

The agglomerated mix consisted of free-flowing, dustless, non-sticky, loosely-compacted aggregates.

The particle size of the said aggregate in comparison with the initial unagglomerated particle is indicated by the screen analysis shown in the following table.

Screen Size	Per Cent Collected on Screen	
	Initial Mixture	Agglomerated Mixture
On 20 Tyler Mesh	—	6.5
On 24 „ „	—	1.5
On 35 „ „	1.7	11
On 48 „ „	6.5	22
On 65 „ „	27.0	19.5

The rest of the particles passed through the 65 mesh screen.

The agglomerated mix wetted-out in about 30 seconds and produced a smooth batter with no lumping when stirred into a slurry in a ratio of 3.5 parts of water to 6.5 parts of mix. By way of comparison, the unagglomerated mix wetted-out in 40 seconds and produced a lumpy batter. The agglomerated mix is eminently suitable for use as a component in a prepared dry cake mix and will bake into an excellent cake with additional ingredients consisting of 2% leavening, 2% milk solids, 1% sodium chloride and 4% cocoa, said percentages being by weight of the total dry cake mix.

EXAMPLE 2

Example 1 was repeated except that the spraying time was increased to 4.5 minutes with the result that the agglomerated mix attained a moisture content of about 5.8%.

The agglomerated mix consisted of free-flowing, dustless, non-sticky aggregates having a particle size as indicated by the screen analysis shown in the following table:

Screen Size	Per Cent Collected on Screen
On 20 Tyler Mesh	8
On 24 „ „	1.5
On 35 „ „	12
On 48 „ „	23
On 65 „ „	18

The rest of the particles passed through the 65 mesh screen.

The agglomerated mix wetted-out in about 22 seconds and produced no lumping of batter when tested by the method described in Example 1. The dry mix can be conveniently used in a cake mix formulation for the preparation of good quality cakes.

EXAMPLE 3

A culinary mix was prepared in the following manner:

A batch of wheat flour was cooled to a temperature of about −50°F. and then agglomerated in a horizontal cylindrical chamber having a diameter of about 2 feet and a length of about 2 feet, and rotating about its axis at 20 rpm. A sticky binding liquid was then prepared by heating a plastic glyceride shortening to about 160°F. and maintaining it at about that temperature level. The shortening consisted of about 94% of a mixture of soybean and cottonseed oils hardened to an iodine value of about 70 to 75, blended with about 6% of vegetable oil hardstock. The shortening had a Solids Content Index of about 20 at 70°F. as determined by the method described in Volume 31 of the Journal of the American Oil Chemists Society, pages 98-103, (March 1954). This melted shortening, under a pressure of about 1000 psi, was sprayed on to the flour from an atomizing nozzle for 13.6 minutes while the cylinder was being rotated at a speed of about 20 rpm to produce an agglomerated mix having a total shortening content of about 38.2 per cent.

71°C

The agglomerated particle size is indicated by the screen analysis shown in the following Table:

Screen Size	Per Cent Collected on Screen
On 7 Tyler Mesh	6.7
On 14 „ „	11.9
On 20 „ „	52.6
On 42 „ „	25.9

The rest of the particles passed through the 45 mesh screen.

In comparison with the final aggregates, all of the initial unagglomerated particles passed through a 100 mesh screen.

The agglomerated mix was free-flowing and non-sticky. Its high suitability for the convenient preparation of a pastry mix was shown by its ready hydration and water acceptance to form a lump-free dough when mixed with water in the proportion of about 1 part water to 5 parts mix by weight.

When a sugar solution is used as the binding agent, its concentration can be varied somewhat from the preferred 3:1 weight ratio of sugar to water shown in Examples 1 and 2 above, and still produce a highly wettable, non-sticky, free-flowing agglomerate without drying. Satisfactory results are generally obtained by using ratios of from 1.5:1 to 4:1 parts by weight of sugar to water.

In the use of sucrose solution for spraying a prepared cake mix comprising from 25 to 50 weight per cent flour, from 5 to 20 weight per cent shortening, from 30 to 50 weight per cent cane sugar, and small amounts of other ingredients, it is preferable to use a substantially 3:1 concentration of sucrose to water in an amount which is sufficient to produce a moisture content in the agglomerated mix solids

of about 5%, although the moisture content of the said mix can vary from about 2 to about 10 weight per cent without loss of the primary benefits of this invention.

Similarly, edible liquid fats and oils other than the melted shortening shown in Example 3, above, can be used in the process herein described with comparable results.. For example, any of the ordinary plastic, semi-fluid or liquid glyceride shortenings of animal, vegetable, marine, or synthetic origin are usable so long as they have inherent sticky characteristics, and are applied as a fine spray of liquid, and in an atomized form, on to the powdered food particles. These glycerides can have saturated or unsaturated long chain fatty acid groups having from about 12 to about 22 carbon atoms and are generally obtained from edible oils and fats such as cottonseed oil, soybean oil, coconut oil, rapeseed oil and lard. The glycerides also can contain one or two short-chain fatty acid groups having from about 2 to about 10 carbon atoms or can be prepared by various random or low-temperature interesterification reactions.

The shortenings can also contain various amounts of emulsifiers and other agents such, for example, as mono- and diglyceride emulsifiers, lactylated glyceride emulsifiers, free fatty acids, and numerous other substances commonly used in shortenings to improve their cooking and other properties. In the case of the hardened glycerides or the plastic shortenings, it is necessary that they be sufficiently heated to become liquid and atomizable, and maintained at about that temperature. In general, cooling before atomization should be avoided since it is necessary to prevent crystallization of the shortening before it is sprayed on to the tumbling dry particles.

While the amount of liquid shortening to be sprayed can be varied, depending somewhat on the ultimate agglomerated composition desired, a free-flowing pastry mix can be prepared by spraying from 15 to 45, preferably from 25 to 40, parts by weight of shortening on to 55 to 85, preferably from 60 to 75, parts by weight of dry particles consisting principally of flour.

In order to maximize the flowability and mixing properties of a pastry mix comprising flour and shortening, it is preferable to spray a shortening having a Solids Content Index at 70°F. in excess of 5. The shortening should be heated until it is completely melted and then maintained at about that temperature so that it can be sprayed on to the agitated dry particles while still liquid. The dry particles can also contain various other ingredients of pastry doughs such as salt, dextrose, starch and flavouring materials.

The flour employed in this invention is of the sort commonly used in present-day culinary mixes of the types herein described. For example, with cake mixes it is preferable to use a bleached cake flour, although hard wheat flours or general purpose flours can also be used. For pastry mixes it is preferable to use an unbleached pastry flour, although other types of flour can be used in some instances, if desired.

Although the invention has been described with particular reference to prepared mixes such as flour-containing culinary mixes, the invention is not limited thereto; other pulverulent materials such, for example, as dry milk solids and confectionery powders may be treated in the hereinbefore-described manner to produce non-sticky, free-flowing, easily wettable aggregates.

WHAT WE CLAIM IS:—

1. A method of agglomerating particles of a pulverulent material which comprises contacting the particles with a fine spray of a sticky cohesive binding liquid obtained by passing it through an atomizing nozzle under high pressure, said binding liquid being either a concentrated aqueous sugar solution having a weight ratio of sugar to water of from 1.5:1 to 4:1 in an amount such as to give a total moisture content of the treated particles of from 2 to 10% by weight or being a melted or normally liquid glyceride shortening, and agitating the particles in a gentle manner sufficient to blend the liquid uniformly therewith and to roll up the treated particles upon each other into free-flowing, non-sticky aggregates without drying said aggregates having a larger average particle size than the unagglomerated constituent particles and improved blending and mixing properties in aqueous systems.

2. A method according to claim 1 in which the pulverulent material is a pulverulent flour-containing food mix.

3. A method according to claim 1 or 2 in which the sticky cohesive binding liquid is a concentrated aqueous sugar solution having a weight ratio of sugar to water of substantially 3:1.

4. A method according to any of the preceding claims in which the binding liquid is a concentrated aqueous sugar solution, and the pulverulent material agglomerated is a pulverulent cake mix comprising from 25 to 50% by weight flour, from 5 to 20% by weight shortening and from 30 to 50% by weight cane sugar.

5. A method according to claim 1 or 2 in which the sticky cohesive binding liquid is a melted glyceride shortening having a Solids Content Index at 70°F. greater than 5.

6. A method according to claim 1, 2 or 5 in which the binding liquid is a melted or normally liquid glyceride shortening and the pulverulent material agglomerated consists of from 55 to 85 parts by weight of a food mix consisting principally of flour and from 15 to 45 parts by weight of shortening.

7. A method according to claim 6 in which

the pulverulent material agglomerated consists of from 60 to 75 parts by weight of a food mix consisting principally of flour and from 25 to 40 parts by weight of shortening.

8. A method of agglomerating pulverulent flour-containing food mixes substantially as hereinbefore described in any of the Examples.

9. An agglomerated flour-containing food mix prepared by a method according to any of the preceding claims.

For the Applicants,
CARPMAELS & RANSFORD,
Chartered Patent Agents,
24, Southampton Buildings,
Chancery Lane, London, W.C.2.

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